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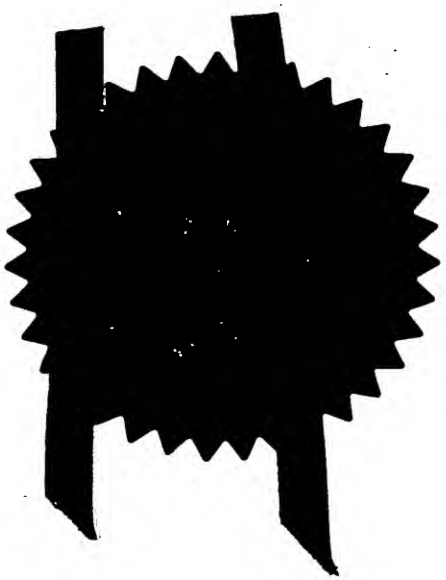

Signed R. Mahoney

Dated 1st August 2000

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1. Your reference — 5196

28APR00 E532967-1 D02969
P01/7700 0.00-0010328.3

2. Patent application number *(The Patent Office will fill in this part)* — **0010328.3** — 28 APR 2000

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

BG Intellectual Property Ltd
100 Thames Valley Park Drive, Reading,
Berkshire, RG6 1PT, GB

Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation — England & Wales — 7817760001

4. Title of the invention

Tee Connection to a Pipeline

5. Name of your agent *(if you have one)*

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

John R W Burridge
BG Intellectual Property Ltd
100 Thames Valley Park Drive,
Reading, Berkshire. RG6 1PT. GB

Patents ADP number *(if you know it)* — as above

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*
GB	9917360.1	24 Jul 1999

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicants named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

yes

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9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	11
Claim(s)	4
Abstract	1
Drawing(s)	5

10. If you are also filing any of the following, state how many against each item.

Priority documents	
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Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	1
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature J. R W. Burridge Date 28 April 2000

12. Name and daytime telephone number of person to contact in the United Kingdom

John R W Burridge 01189 29 2071

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DUPLICATE

TEE CONNECTION TO A PIPELINE

The present invention relates to tee or branch connections to a pipeline and, more particularly, to a method of connecting tee or branch assemblies to pipelines such as gas or water mains.

An existing technique for repairing damaged steel pipelines uses basically two half-shells which are secured together to form a shell assembly which encircles the pipeline leaving an annulus between the pipeline and the shell assembly which is filled with grout that bonds the shell assembly to the pipeline wall. The epoxy grout thus fills and surrounds the damaged region and supports the damaged pipeline wall.

An object of the present invention is to provide a method of securing tee or branch connections to pipelines.

According to the invention, a method is provided for securing a branch assembly to a pipeline, wherein the branch assembly comprises a first part for locating on the side of the pipeline remote from the side from which the branch is to extend, and a second part incorporating the branch, the method comprising positioning a containment ring on the pipeline at the required position on the pipeline and surrounding the area from which the branch is to extend, positioning an annular seal on the pipeline so that the seal is wholly radially within the containment ring, positioning

the second part of the branch assembly onto the seal, positioning the first part of the assembly on the pipeline and securing the first and second parts together so as to compress the seal and leave an annular space between the first and second parts and the external surface of the pipeline, providing sealing means for substantially preventing grout from escaping from the annular space, and introducing into the annular space grout that cures to bond the branch assembly in position on the pipeline.

It will be appreciated that subsequent to the branch assembly becoming bonded to the pipeline, a known procedure can be executed for cutting a coupon out of the pipeline via access through the branch under "live" conditions of the pipeline.

It will also be appreciated that the annular seal must be sufficiently compressible, and also sufficiently robust to withstand and contain with the containment ring line pressure during operation of the pipeline over the working pressures.

The grout may, for example, be selected from the following range:

urethanes, polyesters, acrylics, epoxies and cemtatious compounds. It will be appreciated that each should be selected to satisfy the operating temperature, humidity and curing rate which then leads to the different adhesion

Case No 5028

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pipeline at the required position on the pipeline and surrounding the area from which the branch is to extend, positioning an annular seal on the pipeline so that the seal is wholly radially within the containment ring, positioning the second part of the branch assembly onto the seal, positioning the first part of the assembly on the pipeline and securing the first and second parts together so as to compress the seal and leave an annular space between the first and second parts and the external surface of the pipeline, providing sealing means for substantially preventing grout from escaping from the annular space, and introducing into the annular space grout that cures to bond the branch assembly in position on the pipeline.

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The grout may, for example, be selected from the following range:

urethanes, polyesters, acrylics and epoxies. It will be appreciated that each should be selected to satisfy the operating temperature, humidity and curing rate which then leads to the different adhesion strengths for different applications. Different grout material provides a different exothermic reaction which will determine the volume change after installation. It will also be understood that the volume change of epoxy grout should be optimized to minimize the internal stress system within the grout.

In order to ensure there is a good key for the grout, the external surface of pipeline and the inner surface of the first and second parts of the branch assembly may be dressed up or grit blasted prior to the assembly being mounted on the pipeline.

The invention will now be described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 shows schematically the top and bottom parts of a branch assembly to be used in a method according to the invention;

Figure 2 is a schematic plan view of a pipeline on which is positioned a containment ring and an annular sealing ring in preparation of the pipeline receiving the top part of the branch assembly;

Figure 3 is a schematic side view of the pipeline on which the top and bottom parts of the branch assembly have been secured together in position; and

Figure 4 is a schematic view in the direction of arrow A in Figure 3.

With reference to Figure 1, there is shown a branch assembly 1 comprising a first part 2 forming the upper part of the assembly and a second part 3 forming the lower part.

The upper part and lower parts of the assembly 1 are made of carbon steel and have generally part cylindrical portions 4 and 5, respectively, which are securable together about a pipeline 6 via flanges 7 and 8 which extend longitudinally along each side of the upper and lower parts, as can be clearly seen in Figure 3.

The flanges 7 of the upper part 2 have apertures 9 which are intended to align with apertures 10 in the flanges 8 of the lower part 3 so that securing bolts 11 (see Figures 3 and 4) can be passed therethrough to secure the two parts 2 and 3 together on the pipeline.

The upper cylindrical portion 4 includes an apertured section 12 from which extends a short branch pipe 13 terminating in an annular flange 14 to which a branch pipeline having an end flange can be connected in a known fashion (not shown) after the assembly 1 is securely bonded to the pipeline 6.

By way of illustration of the invention, a method of securing the tee assembly 1 to a steel pipeline is described below.

Initially, the area of the external surface of the pipeline to which the branch assembly is to be secured is grit blasted (not shown), as are the inner surfaces of the part-cylindrical portions 4 and 5 of the upper and lower parts of the branch assembly.

A containment ring 16 made of steel and shaped so as to conform to the shape of the pipeline is positioned on the pipeline around the area 6a from which the branch pipe 13 of the branch is to extend.

An annular seal 17 made for example of rubber or polymer and metal and of greater thickness than the containment ring 16 is then placed within the containment ring so as substantially to conform to the shape of the pipeline 6 (see Figure 2).

The upper part 2 of the branch assembly is lowered onto the seal 17, with the bore 13a of the branch pipe 13 being centralised with the area 6a surrounded by the seal and containment ring, the lower part 3 is moved into position on the pipeline, and the upper and lower parts 2 and 3 of the assembly are secured together by means of bolts 11 used in association with the aligned apertures 9 and 10 in the flanges 7 and 8 (see Figures 3 and 4).

Jacking bolts 18 are mounted in the wall of the lower part 3 of the branch assembly. These jacking bolts extend through the wall of the lower part to engage or bear on the surface of the pipeline 6, and can be turned from outside of the assembly to be loosened or tightened against the wall of the pipeline. The jacking bolts 18 are adjusted so that the annular seal 17 is sufficiently compressed to provide a suitable seal prior to the introduction of epoxy grout.

Once the tee assembly 1 is in position on the pipeline, a generally cylindrical or annular space or gap 19 is left or defined between the upper and lower parts 2 and 3 and the external surface of the pipeline 6.

The annular space is bounded by sealing means 20, such as suitable putty which is located between the branch assembly

and the pipeline at the opposite ends of the assembly, and by the annular seal 17.

The grout is then injected into the annular space 19 via injection opening 21, located towards the bottom of the lower part of the assembly, to fill the annular space. An outlet opening 22 for expressed air and excess injected grout is provided in the upper part of the assembly. After the annular space 19 is filled with grout, the grout is allowed to cure and thereby bond the upper and lower parts 2 and 3, and thus the branch assembly 1, to the pipeline.

When the assembly is securely bonded by the grout to the pipeline, the jacking bolts 18 can be, optionally, loosened off to ensure load is fairly or more evenly distributed on the pipeline by the grout.

With the branch assembly securely bonded to the pipeline, known 'live' procedures can be performed for cutting out a coupon from area 6a of the pipeline (not shown) and joining a branch pipeline (not shown) to the branch utilising the branch pipe 13. Such known procedures will not be described here.

A method according to the invention, an example of which is described above, enables a branch assembly to be bonded to a pipeline without having to employ welding techniques. This

is a particular advantage where 'live' pipelines are involved, especially where there are high product flow rates through the pipeline. Other advantages of using such a method include minimising unnecessary pressure reduction in the pipeline and enable cost savings for installations.

CLAIMS

1. A method for securing a branch assembly to a pipeline, wherein the branch assembly comprises a first part for locating on the side of the pipeline remote from the side from which the branch is to extend, and a second part incorporating the branch, the method comprising positioning a containment ring on the pipeline at the required position on the pipeline and surrounding the area from which the branch is to extend, positioning an annular seal on the pipeline so that the seal is wholly radially within the containment ring, positioning the second part of the branch assembly onto the seal, positioning the first part of the assembly on the pipe line and securing the first and second parts together so as to compress the seal and leave an annular space between the first and second parts and the external surface of the pipeline, providing sealing means for substantially preventing grout from escaping from the annular space, and introducing into the annular space grout that cures to bond the branch assembly in position on the pipeline.

2. A method as claimed in claim 1, wherein the first part forms the lower part of the assembly and the second part forms the upper part of the assembly.

3. A method as claimed in claim 1 or 2, wherein the annular seal is made of rubber or of a polymer and metal composite.

4. A method as claimed in any of the preceding claims, wherein the grout is injected into the annular space between the first and second parts and the external surface of the pipeline.

5. A method as claimed in any of the preceding claims, wherein jacking means are employed to space the first part from the pipeline when the first and second parts have been secured together on the pipeline.

6. A method as claimed in claim 1 and substantially as hereinbefore described with reference to the accompanying drawings.

ABSTRACT

Figure 3

TEE CONNECTION TO A PIPELINE

A method is provided for securing a branch assembly 1 to a 'live' pipeline 6. An upper part 2 of the assembly incorporating the branch 13 is positioned on the pipeline over a containment ring 16 located on the pipeline and within which there is an annular seal 17 surrounding an area 6a from which the branch is to extend. A lower part 3 of the assembly is positioned on the pipeline beneath the upper part and the two parts are secured together so that the seal is compressed and an annular space 19 is left between the two parts and the external surface of the pipeline. Grout is injected into the annular space 19 and cures to bond the two parts forming the branch assembly in position on the pipeline. The use of grout avoids having to use welding techniques on a 'live' pipeline. A coupon can be cut out of the pipeline, via the access through the branch.

INFORMAL

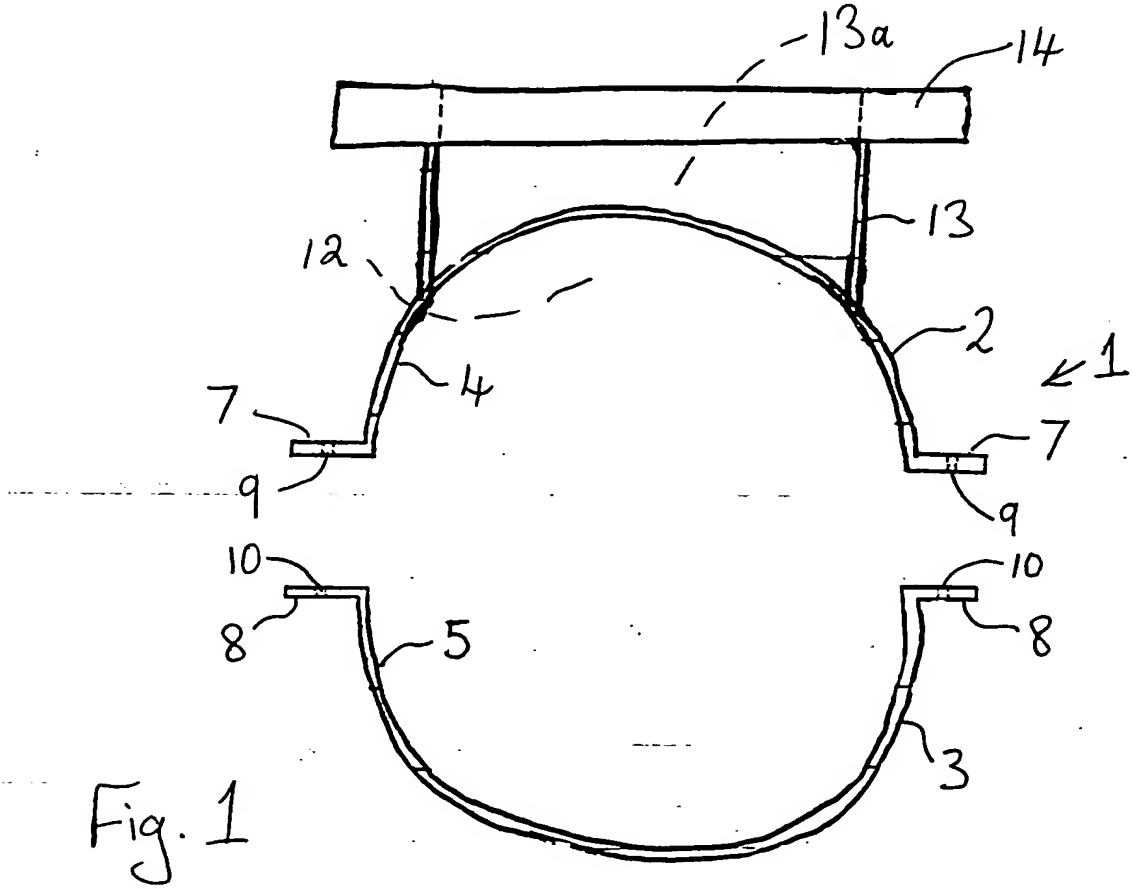

Fig. 1

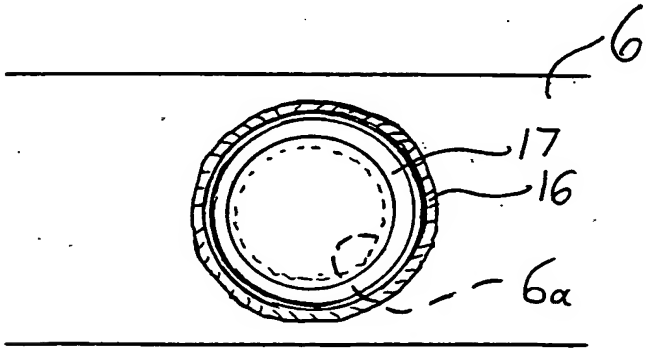

Fig. 2

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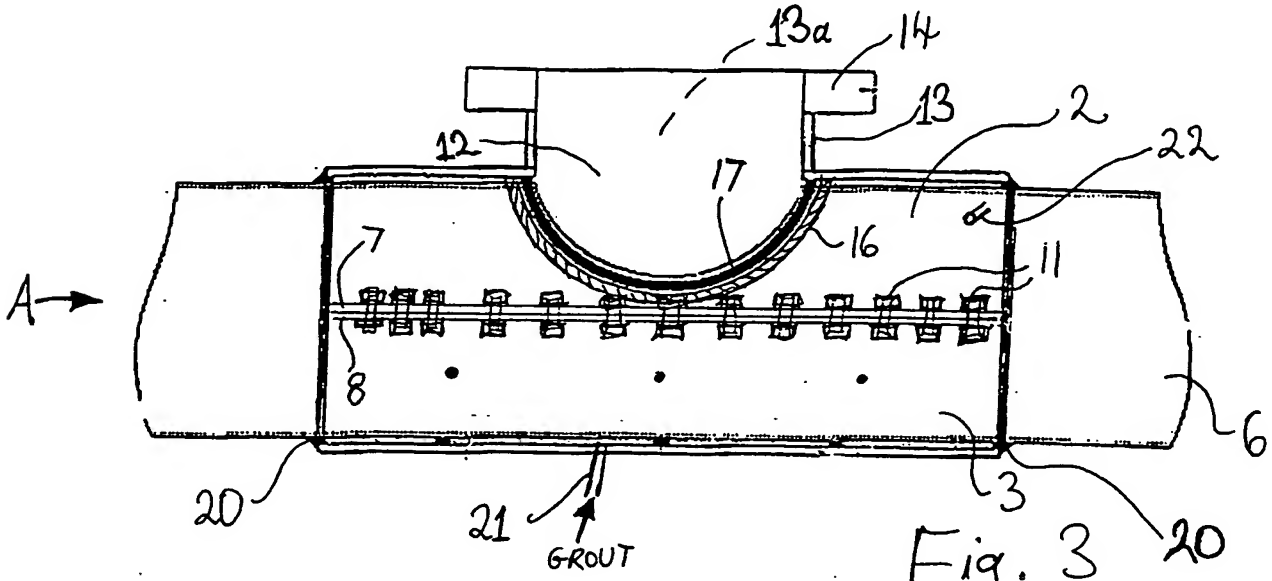

Fig. 3

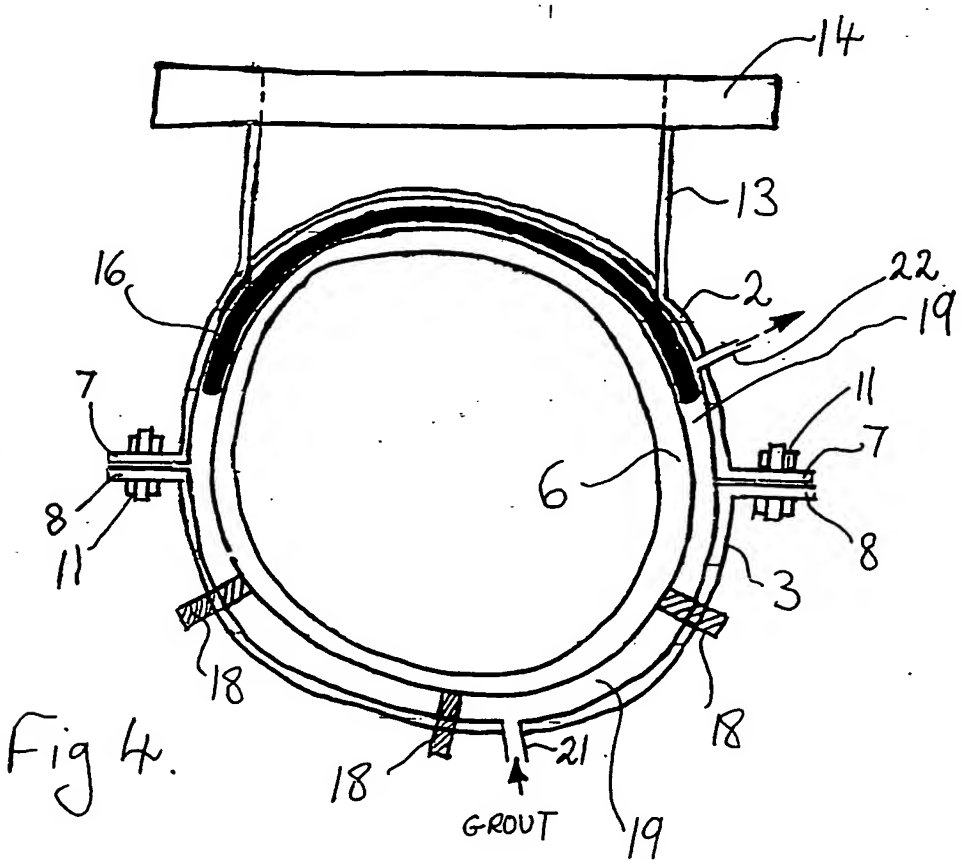

Fig 4.

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23/77 filed 25-7-2000

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